

Emerging Array Antenna Technologies at JPL*

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Abstract

NASA's future and current developing spacecraft all demand their high-gain antennas to achieve low mass, high packaging efficiency, and low cost. In pursuit of such goals, three advanced array antenna technologies are being developed at the Spacecraft Antenna Research Group of the Jet Propulsion Laboratory. One is the microstrip reflectarray technology. With its flat reflecting surface, the microstrip reflectarray can achieve a lower mass and simpler deployment mechanism than a curved parabolic reflector. In addition, it has the capability of integrating with the solar array. A half-meter Ka-band microstrip reflectarray has recently been developed with excellent performance results. An X-band reflectarray with printed dipoles is currently being developed for integration with a solar array. The second technology being developed is the frame-supported thin-membrane array antenna. Multiple frames can be easily folded and deployed by spring-loaded hinges to achieve good packaging efficiency. Microstrip patches are printed on thin membranes to achieve low mass, while T/R modules and phase shifters are to be mounted on the rigid frames to provide electronic beam scanning capability. The third technology is the inflatable array antenna where the gas-inflated tubes are used to support the large thin-membrane array surface. Significantly reduced mass, excellent packaging efficiency, and low-cost deployment mechanism can be achieved with this technology. An inflatable L-band 3m x 1m SAR array and a 1m X-band inflatable microstrip reflectarray have recently been developed to demonstrate the usefulness of the inflatable array technology.

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